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Construction of Independent Learning Network Platform for Professional Course "Reliability Theory"

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Abstract: The development of the network technology offer a good platform for the independent learning of the engineering students, metacognition theory is introduced into the construction of the independent learning network platform. First, the relating researches are summarized. Second, independent learning online and metacognition theory are studied respectively, and the relationship between the independent learning online and metacognition is discussed. And then the elements of network independent learning are analyzed, and the independent learning network platform is designed. Then the network platform of course "reliability theory" is established, and the independent learning effect is improved through actual application, engineering students are satisfied with this network platform, and obtain good independent learning ability.

Keyword: independent learning; engineering students; metacognition theory; network platform.

The rapid development of internet has changed the educational environment, which offers convenient information processing platform and diversified communication approach and so on. Therefore the network provides the rich learning resources, and the many web-based independent learning platforms are constructed, and students can study independently based on the network platform. With the social development, knowledge updates regularly, therefore life-long learning era has come. In this era the engineering students should master the latest science and technology, and they require continuous learning. Independent learning ability of the engineering students is a critical factor that decides if the engineering students can grasp the latest technology quickly. In recent years, engineering students have poor independent learning ability, and they lower scientific quality. So the engineering students can carry out independent learning online. The independent learning based on web can make engineering students separate from teacher, and the teacher role and the teaching management is easy to be weakened. Massive information under network environment can lead to the information overload of engineering students, and the randomness of information organization can make the engineering students choose the effective information with difficulty, and the engineering students have some deficiency in self-monitoring, therefore in order to achieve the effective independent learning of engineering students. The independent learning network platform in view of metacognition is designed, which can offer the essential metacognition support, and the independent learning ability of the engineering students can be improved.

1 Literature review

In recent years, independent learning based on metacognition and network technology has been concerned by many scientists, and some good achievements have been obtained. Lucia Mason et al. examined epistemic metacognition as a reflective activity about knowledge and knowing in the context of online information searching on the Web, and they studied whether Internet-based learning was influenced by epistemic metacognition and the individual differences examined, results showed that prior knowledge was not related to epistemic metacognition in the search context [1]. Mornar Vedran et al discussed the use of the blended e-learning model, which was based on a mixture of collaborative learning, problem-based learning, and independent learning, which was realized as a combination of a face-to-face environment and online learning. Results showed that showed that students were satisfied with the pedagogical approach, and their academic achievements were better than expected [2]. Ching-Huei Chen et al tested the unique and interactive effects of cognitive and motivational variables when learning in a supportive online learning system based on a path model, and explored the relationships between students' motivational, cognitive, and metacognitive strategy use and online

performance. Results showed that students' learning goals and cognitive preferences predicted metacognitive strategy use and later influenced their performance [3]. C. G. Knobbs et al. presented a curriculum innovation in which so-called 'soft' skills, specifically inter-personal and intra-personal skills, this method was established to improve independent learning and develop non-technical skills, essential for students on the threshold of becoming practicing engineers. Results showed that students' appreciation of the need for these skills, as well as their own perceived competence, increased during the course, and their ability to function as independent learners also increased [4]. Nada Dabbagh studied the Personal Learning Environment or PLE that can integrate formal and informal learning based on social media and support student self-regulated learning in higher education contexts, and conceptualized the connection between PLE, social media, and self-regulated learning. A three-level pedagogical framework for using social media was provided to create PLEs that support student self-regulated learning [5]. Pao-Nan Chou explored engineering students' self-directed learning abilities in an online learning environment. The instructional activity in one experimental study was to simulate an online learning task in the real-world online courses, results of the study showed that a significant, positive relationship existed between engineering students' self-directed learning abilities and online learning performances [6]. Karsten Stegmann explored the relation between argumentation in online discussions, cognitive elaboration, and individual knowledge acquisition. The effect of an argumentative computer-supported collaboration script (with vs. without) on the formal quality of argumentation, cognitive elaboration, and individual knowledge acquisition in online discussions was studied. Results showed that a computer-supported collaboration script can foster formal quality of argumentation as well as corresponding cognitive elaboration [7]. As seen from the existing research achievements, the metacognition theory has been integrated into independent learning, and the learning effect of students has been promoted. At the same time, the independent learning based on network has been applied in the teaching procession, and the teaching level has been improved, however the independent learning network platform based on metacognition theory is unusual, especially for independent learning of engineering students, it is necessary to study the construction of it.

2 Characteristics of Independent Learning Online

At present network learning has become the main independent learning means for engineering students, and the network learning is necessary supplement for the classroom teaching. Currently independent learning is a main mode of network learning, which centers the engineering students, and engineering students are in the positive status, and changes the passive acceptance situation of engineering students, and stimulates their interest in learning, and develop the creativity. The network independent learning has the following characteristics [8]:

(1) Network independent learning breaks up the limit of the space time

The network independent learning can break through the space time. Engineering students can not only obtain the teaching information to study at any time, but also learn repeatedly, and the learning effect of independent learning can be ensured.

(2) Network independent learning contributes to interaction between teachers arid students

The real-time and non real-time two-way communication between teachers and students can be achieved through BBS (bulletin board system), E-mail, QQ groups and suspect-replying system and other network connections, and the teachers and students can interact effectively, and the good teaching effect can be obtained.

(3) Network independent learning benefits individualized learning

Engineering can choose learning content and procession independently according to the own actual situation in the procession of the network independent learning, and the learning motivation of engineering students can be developed well.

(4) Network independent learning advantageous to individualized learning

Engineering students can always communicate with each other and share all kinds of learning resources through the network. Engineering students can carry out effective learning in depth based on completing the learning task together through network discussion exchanges, cooperation, and competition.

The network independent learning can bring some problems, which are listed as follows [9]:

(1) Engineering students lack the learning self-discipline

Questionnaire investigation is carried out among the engineering students in Liaoning Shihua University, 400 questionnaires are issued, and 357 questionnaires are collected. According to the findings of questionnaire investigation, most engineering students do not know their learning characteristics, and spend less time on independent learning, 71% engineering students spend less one hour on studying, and 22% engineering students spend about 2 hours on studying, only

7% engineering students spend over 2 hours. One-third of those surveyed can not make the independent study plan and sort out the learning content in time. Because the network teaching management is loose, the learning consciousness and self-discipline of the engineering students are relative poor.

(2) Engineering students can not get learning guidance in time.

Under network environment, the interaction between the teachers and students relatively lacks, and engineering students do not communication each other, therefore engineering students can not get the guidance of teachers when they encountered difficulties in learning, and they will have serious psychological fear, severe cases will cause engineering students be weary of studying

(3) Network independent learning lacks effective feedback mechanism

Network independent learning has the characteristics of separating from space to time. Although the network course can offer some self-test questions, but engineering students only know the existing problems, and they can not get the feedback information in time. Therefore, during the procession of independent learning engineering students have somewhat learning burnout phenomenon.

3 Independent Learning and Metacognitive Theory

(1) Independent learning theory

Independent learning theory is not only a learning attitude, but is also a ability of independent learning. Independent learning can develop the subjective initiative of engineering students fully, and make engineering students choose and decide the various aspects of learning with a positive attitude, and the good learning effect can be obtained.

There are some factors affecting the improvement of the independent learning ability of engineering students, which are listed as follows:

(a) Some engineering students do not take specialized course seriously; they think that professional knowledge is applied in the actual work rarely. They lack understanding of raising their own professional qualities.

(b) The teaching content of specialized course has relative low update speed, however with the rapid development of science and technology the update speed of professional knowledge increase quickly, but the current teaching content does not follow the frontiers of scientific development, therefore the engineering students are not interested in specialized course.

(c) The teaching method of specialized course is improper, and the learning enthusiasm of engineering students can not be aroused well. During the procession of traditional classroom teaching, the teachers rarely communicate with engineering students, the independent learning platform is relatively few, and the engineering students can not get the guidance of independent learning method.

At present, some engineering students have been aware of the importance of independent learning, and they hope to improve their independent learning ability, but there is no independent learning platform for support the independent learning of engineering students, therefore it is necessary to establish the independent learning platform based on network.

(2) Metacognitive theory

The metacognition is a cognitive activity that regulates the cognitive process. The metacognition concludes the metacognitive knowledge, the metacognitive experience, the metacognitive monitoring and control. The object of metacognitive knowledge is on the individual, task and strategy. The metacognitive experience often accompanies cognition and emotion during the intellectual activity. The metacognitive monitoring and control is a regulating mechanism that is used in the procession of solving the actual problems. The three main factors interact during the procession of cognitive activity [11].

(3) Relationship between the metacognition and the independent learning online

Engineering students should set learning goals, making a study plan, and do good preparation for studying before the learning activity, and they should self check, summarize and evaluate the learning procession. The network independent learning put forward higher requirements for metacognition ability, such as self-monitoring and self-regulating ability, therefore the independent learning and metacognitive ability of the engineering students are the critical affecting factors for network independent learning. Metacognition procession is an important part of network independent learning, and the network independent learning is achieved under the metacognitive monitoring and control. Through network independent learning, engineering students can develop their metacognitive level, they can accumulate more metacognitive knowledge,

improve the metacognitive monitoring and controlling ability, therefore the learning efficient of engineering students can be improved, and the sense of self-worth of the engineering students can be promoted [12].

4 Elements of Network Independent Learning

Network independent learning platform is made up of four elements: engineering students, learning tool, learning resources and teachers.

(1) Engineering students

Engineering students are the main body of independent learning; network independent learning emphasizes "student-centered" teaching method. Engineering students can search, read, analyze, identify, and process the learning resources based on network, they can construct the knowledge preliminarily, and therefore engineering students can control the whole learning process. Every action of engineering students can affect the learning effect.

(2) Network platform

Network platform is a teaching tool for the whole learning process, which is a basic condition that can achieve the network independent learning. The formidable information resources of network can offer rich learning resources for engineering students, and the network platform can ensure independent exploration of engineering students. At the same time, network platform can offer a series of assisted learning tool to support the communication between teachers and students, for example, network platform can provide the video courses, BBS, exchange area of students. An opening and sharing platform between teachers and students, these and those students is constructed. The network platform can evaluate the learning process and effect of the engineering students, and adjust the learning method according to the evaluating results.

(3) Learning resources

One of the distinct characteristic of the network is the rich source of information, engineering students can obtain the information needed conveniently based on the search engine of computer. Network platform can help the engineering students study specialized course, which can offer the broad space for independent learning.

(4) Online tutor

During the procession of independent learning, engineering students also need the guidance of the teachers; therefore network platform can be acted as a teacher.

5 Design of Independent Learning Network Platform

(1) Independent learning resources

Independent learning resources conclude conventional and special teaching resources. Conventional teaching resources mainly conclude teaching program, Course description, course standard, teaching plan, exercises, multimedia courseware, examination items, teaching effectiveness assess and so on. The special teaching resources conclude expert course, hotspot, animation demo, teaching video, online test, course forum, interactive platform between the teachers and students. The special teaching resources are an important part of the independent learning platform; it should not only highlight the characteristics, has peculiar style, but also show the level of teaching and research of specialized course.

The construction of course resources concludes developing, collecting and organizing the independent learning resources of engineering students. The teaching resources with the characteristic of ease-to-use and ease to-update can be constructed based on computer, network, and digital technology. The figure, color, and font should be matched appropriately. The content of independent resources should be correct, standard, and complete.

(2) Web page design

The network center of college is in charge of technical support for the operation and maintenance of the network learning platform. The web design can be carried out based on Dream weaver software, and the image used in the web page can be designed based on Photoshop software. The web page of network independent learning platform applies the HTML-ASP dynamic and static mixed information mode. The network learning platform can be compatible with multiple file formats, such as "*.doc", "*.ppt", "*.mp3", "*. rmvb", "*.mov" and so on. During the procession of constructing the network platform, teachers should be in charge of developing the teaching resource databases based on network technology.

(3) Navigation design of independent learning

Independent learning network platform can offer a first-class self studying condition. In order to make every engineering student use the platform easily, a good navigation should be designed. Navigation design of independent learning network platform should manifest the idea of taking students for basis, navigation can help the engineering students overcome psychological fear, and the engineering students can use the network resources easily, then the independent learning of engineering students can be achieved. The navigation structure of independent learning platform is shown in figure 1.
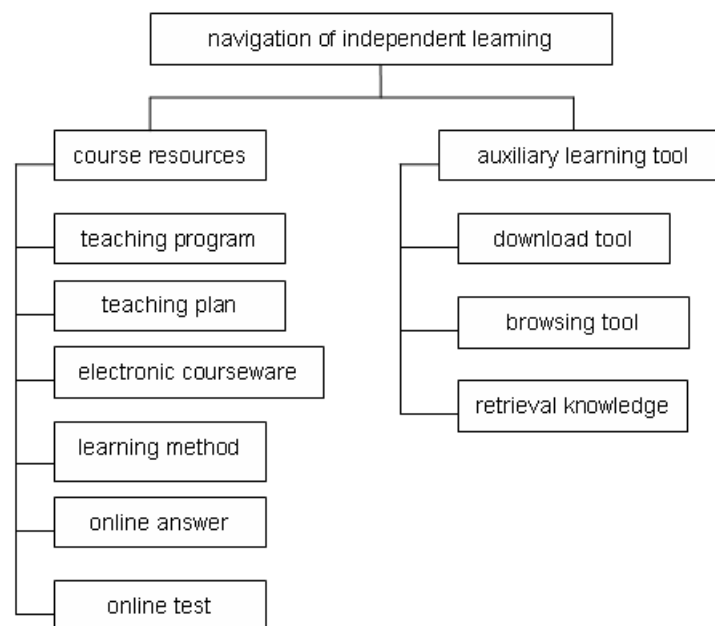

Figure 1 Navigation structure of independent learning network platform

(4) Design of independent learning procession based network platform

Under the independent learning network environment, independent learning based on metacognition conclude the following learning activities: before independent learning, engineering students should choose the learning task, set the learning goals, and make learning plan. During the procession of independent learning, engineering students should search the help of network system, carry out independent inquiry, do self guided learning, and make self records. After independent learning, engineering students can show their learning achievements, carry out self-evaluation, and evaluate other students. Engineering students can find out existing problems during the procession of independent learning, and improve the independent learning method. Engineering students can improve their independent learning ability through using the independent learning network platform, and they can design the proper learning procedure, and regulate their learning procession.

6 Case Study

In order to verify the effectiveness of independent learning network platform based on metacognition, a case study is carried out. The network platform of course "reliability theory" is established, and "reliability theory" is a professional basic course, teaching objects are the engineering students, this course is most closely linked with actual engineering problems, it is difficult to learn, therefore the network platform in view of metacognition is constructed, which can offer a good independent learning environment for engineering students. The layout of network platform is designed based on figure 1. The following main factors are considered:

(1) Enriching independent learning information

The network platform of course "reliability theory" concludes the following materials:

(a) Course information, such as teaching plan, teaching calendar and so on.

(b) Outline of independent learning.

(c) Outside reading materials and independent learning requirement.

(d) Other learning resources, such as relating journal Web, blog, forum and so on.

(e) Assignment and test of independent learning.

In order to make engineering students understand the learning content of course "reliability theory", some pictures, animations, and videos can be put on the network platform, for example, causality diagram is common method for analyzing the fault reason, in order to make the engineering students understand the basic theory of it, corresponding figure should be shown to engineering students during the procession of independent learning, which is shown in figure 2. Engineering students can understand the meaning of the causality diagram through seeing this figure.
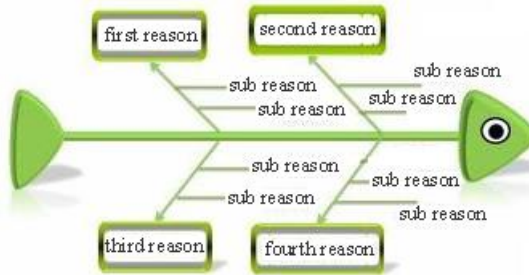

Figure 2 The causality diagram

(2) Achieving the self-control of engineering students

Independent learning focuses on the autonomy of engineering students. However it takes some time for engineering students to learn controlled by themselves. Therefore the network platform should set the monitoring and managing mechanism, some modules are used in the network platform, which is shown in figure 3.
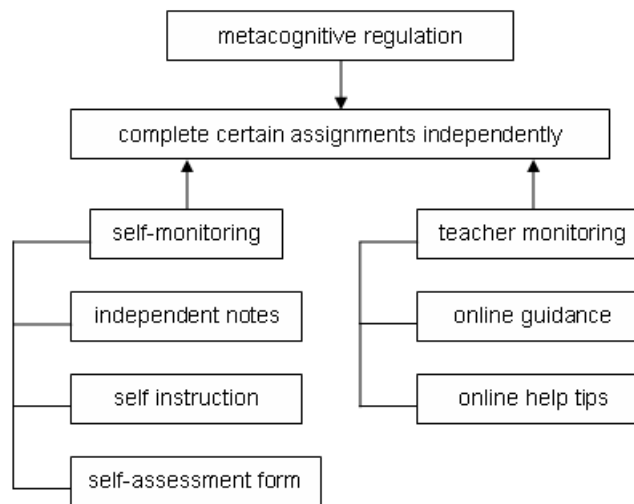

Figure 3 The mornitoring module of independent learning network platform

(3) Strengthening collaborative learning

The network technology can make engineering students conquer time and space, and make up the disadvantage of communication and emotion interaction. The monitoring and control can be strengthened through collaborative learning. The engineering students can deeply understand their according to the evaluation of teachers and other students. The engineering students can understand the knowledge, improve team work experience, and remove loneliness through communicating with other students and teachers, and the common communicating tools can be put on the internet, such as BBS, MSN, QQ and so on.

This network platform is applied in the independent learning of course "reliability theory", and the learning effect of the engineering students is improved, and most engineering students can understand the basic theory of course "reliability theory", at the same time the independent learning ability of the engineering students is improved.

7 Conclusions

Independent learning network platform based on metacognition is established, and the engineering can obtain good independent learning environment. Engineering students should setting clear learning objectives during the procession of applying the network platform, the proper learning method can be applied, and the blind learning can be avoided. Navigation system of independent learning network platform is important for improving the learning effect of engineering students, and the independent learning of engineering students will go well. In addition, teachers should give appropriate help under network environment, and the engineering student can not get lost in the procession of independent learning. Based on the network platform, engineering students can experience pleasure of independent learning, and get the higher independent learning ability of specialized course, and they can be suitable for the development of technology.

Acknowledgement

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